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HOME MIXING OF FERTILIZERS



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HOME MIXING OF FERTILIZERS

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What are commercial fertilizers?

Commercial fertilizers are usually mixtures of materials containing nitrogen, phosphoric acid, and potash. These so-called complete fertilizers may be bought ready mixed, or the ingredients may be bought and mixed on the farm. The fertilizer industry in this country is based largely on factory-mixed goods, but the practice of home mixing has always had its advocates.

For one thing, home mixing is often more economical and affords the farmer an opportunity to prepare fertilizer mixtures adapted to special needs. The farmer not only learns more about fertilizer materials but can select them himself. In many cases it is important to know what form of nitrogen to use. For example, for some crops a large proportion of a quick-acting nitrogen carrier is essential; for others a more slowly acting one, which allows the nitrogen to become available gradually throughout the season, is desirable. The home mixer can, for example, purchase sodium nitrate or ammonium sulphate and be certain that he is obtaining high-grade materials.

In some localities, the farmer has a chance to buy so-called open-formula¹ mixed fertilizers. The company states plainly the ingredients used in making the fertilizer and the pounds of each ingredient in a ton of the mixed product. This system of selling takes away one of the reasons for farmers preferring to do home mixing.

Undoubtedly home mixing is a good thing for many farmers, both financially and educationally, and should be considered where economy is necessary or desirable. Usually, where only a small amount of fertilizer is to be used, it is more convenient to buy commercial mixtures. Such mixtures may also be best adapted to the needs of the farmer who does not have the facilities for home mixing or who is not in a position to study the subject. Home mixing, however, has proved satisfactory in many parts of the country.

¹ The Association of Official Agricultural Chemists has given the following definitions of terms used in this leaflet: (1) Fertilizer formula: The term formula shall be interpreted as expressing the quantity and grade of the crude stock materials used in making a fertilizer mixture. For example, 800 pounds of 16 per cent superphosphate, 800 pounds 9-20 tankage, and 400 pounds of sulphate of potash-magnesia. (2) Analysis: The word analysis, as applied to fertilizers, shall designate the percentage composition of the product expressed in terms of nitrogen or ammonia, phosphoric acid, and potash in their various forms. (3) Unit: A unit of plant food is 20 pounds or 1 per cent of a ton.

The fertilizer materials commonly used are given in Table 1.

TABLE 1.—Composition of the principal commercial fertilizer materials

Fertilizer material	Nitrogen	Phosphoric acid	Potash
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Supplying nitrogen:			
Nitrate of soda.....	15.5 - 16.0		
Sulphate of ammonia.....	19.0 - 20.5		
Dried blood (high grade).....	12.0 - 16.0		
Dried blood (low grade).....	10.0 - 11.0	3.0 - 5.0	
Concentrated tankage.....	11.0 - 12.5	1.0 - 2.0	
Tankage (bone).....	5.0 - 6.0	11.0 - 14.0	
Dried fish scrap.....	7.0 - 10.0	6.0 - 8.0	
Cottonseed meal.....	6.5 - 7.5	1.5 - 2.0	2.0 - 3.0
Castor pomace.....	5.0 - 6.0	1.0 - 1.5	1.0 - 3.0
Calcium cyanamide.....	19.0 - 22.0		
Urea.....	46.0		
Supplying phosphoric acid:			
Steamed bone meal.....	1.0 - 2.5	22.0 - 30.0	
Ground bone (raw).....	2.5 - 4.5	20.0 - 25.0	
Superphosphate (acid phosphate).....		16.0 - 20.0	
Treble superphosphate ¹		40.0 - 45.0	
Basic slag.....		13.0 - 18.0	
Raw ground phosphate rock.....		26.0 - 35.0	
Ammonium phosphate.....	11.0 - 21.0	20.0 - 61.5	
Supplying potash:			
Potassium sulphate.....			48.0 - 52.0
Potassium muriate (chloride).....			48.0 - 60.0
Potassium nitrate.....	13.0		46.0
Kainit.....			12.0 - 16.0
Manure salts.....			20.0 - 30.0
Sulphate of potash-magnesium.....			25.0
Wood ashes.....		1.0 - 2.0	2.0 - 8.0
Dried sheep manure.....	1.51 - 3.09	.95 - 2.50	.33 - 2.24

¹ Also called double superphosphate.

Purchasing fertilizer materials

In the purchase of fertilizer materials good business judgment should be used. Wide competition should be sought and prices procured not only from local merchants but from large fertilizer firms in the home State and adjoining States. Lists of firms may be obtained from the State agricultural experiment stations and the United States Department of Agriculture. Advice should be sought from the county agent. Best prices can be obtained for cash. Materials should be bought well in advance, as this not only insures a better price but allows the use of farm labor in the winter when it is often not occupied profitably. Home mixing may be done in the barn when the weather is too inclement for outside work.

Mixing commercial fertilizers

The mixing of the materials is comparatively simple. Any tight floor or a wagon box may be used, and tools at hand may be employed. (Fig. 1.) The materials are spread in layers, usually the most bulky first, and are thoroughly shoveled together. The mixture is passed through a screen, and any lumps present are broken up with a tamper or the back of a shovel. The author has found a very large long-handled mortar hoe a convenient tool for mixing, but its purchase especially for this purpose is not necessary. Where large amounts are to be mixed it would probably pay to buy a rotary mixer such as is sold for concrete mixing on the farm. The stirring should be continued until the materials are uniformly mixed and show no streaks of color, after which the product may be bagged and stored in a dry place until applied.

To avoid caking and losses of plant-food elements, certain ingredients should not be used together in a mixture. Figure 2 shows materials which may and may not be safely combined.

When making high-analysis mixtures with concentrated materials it is well to include at least 100 to 200 pounds per ton of the mixture of some organic material, such as fish scrap, animal tankage, or cottonseed meal as a conditioner. This holds good especially when the mixture is to be stored.

One of the easiest ways to start home mixing is to duplicate a formula already in use. A beginner should select a mixture which has been successfully used on similar soil on the crop he intends to raise, get a price on the mixed goods, and then find out what a home mixture of similar analysis will cost.

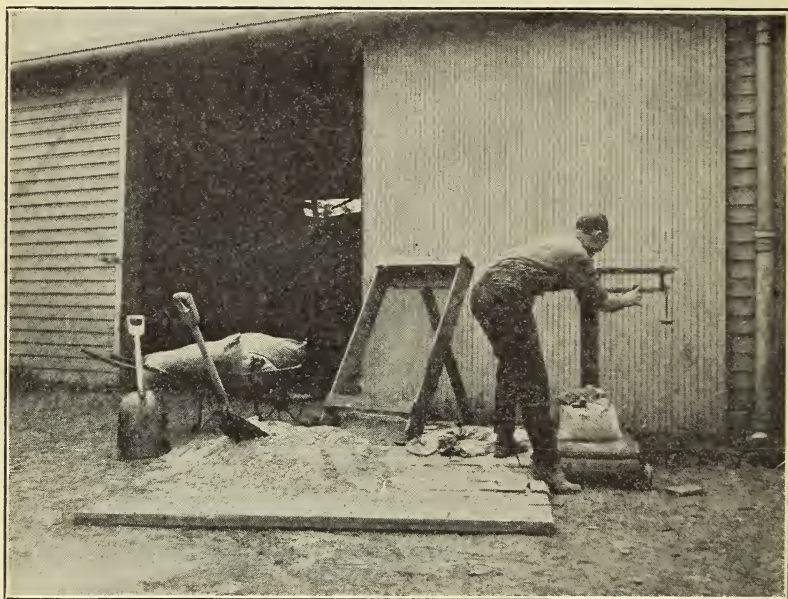


FIGURE 1.—Implements used in home mixing

In making up fertilizer formulas it is well first to decide what percentages are required and then what materials shall be used. Start with the phosphoric acid (P_2O_5). Superphosphate is almost universally used as a source of the phosphoric acid in ordinary-strength fertilizers. With 16 per cent goods if 8 per cent of phosphoric acid is desired in the mixture, the procedure would be as follows: If the whole mixture were superphosphate, it would contain 16 per cent of phosphoric acid; as 8 per cent is desired, make eight-sixteenths (one-half) or 1,000 pounds of the mixture superphosphate; if 6 per cent is wanted six-sixteenths or 750 pounds to a ton would consist of this material. Similarly with nitrogen, if nitrate of soda contains 15.65 per cent of nitrogen and 2 per cent nitrogen is desired, $2/15.65$, or approximately one-eighth of the mixture or 250 pounds in a ton, will be needed. Similarly with potash, if potassium chloride containing 50 per cent of potash is used and 5 per cent

potash is desired, five-fiftieths or one-tenth of a ton of potash (200 pounds) is needed.

Any other material may be used in a similar manner. It is not necessary for the farmer to be exact down to the fraction of a per cent, as fertilizer application is not an exact science and a slight variation in the calculation will not alter materially the agricultural value of the mixture.

Fertilizer materials are often used to advantage without mixing. Examples are superphosphate, basic slag, nitrate of soda, and sulphate of ammonia.

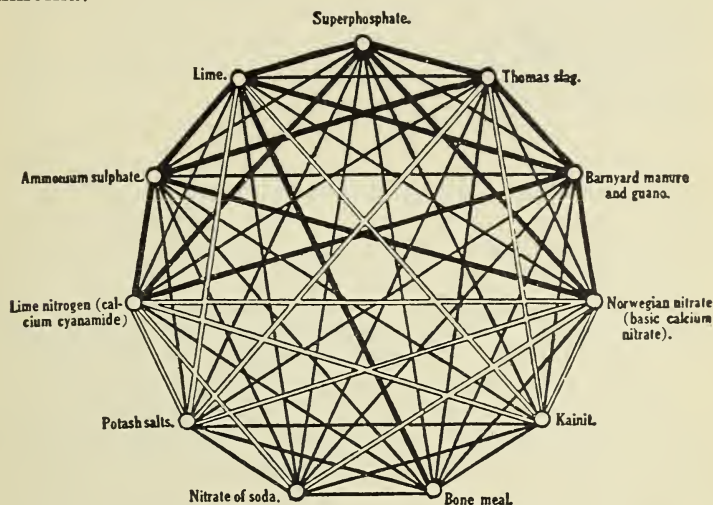


FIGURE 2.—Diagram indicating what fertilizer materials may and may not be safely mixed. The dark lines unite materials which should never be mixed, the double lines those which should be applied immediately after mixing, and the single lines those which may be mixed at any time

Table 2 will be of help in calculating home mixtures. In making ton lots, to get 1 per cent, use amounts shown in the first column; for 2 per cent, use those in the second column, and so on.

TABLE 2.—Quantities of fertilizer ingredients to be used to give definite percentages in a ton of mixture¹

Ingredient	1 per cent	2 per cent	3 per cent	4 per cent	5 per cent	6 per cent	7 per cent	8 per cent	9 per cent	10 per cent
Carriers of nitrogen (N):	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>
Nitrate of soda (15 per cent N).....	133	266	400	532	666	800	933	1,066	1,200	1,333
Sulphate of ammonia (20 per cent N).....	100	200	300	400	500	600	700	800	900	1,000
Cottonseed meal (7 per cent N).....	285	571	856	1,142	1,428	1,714	2,000	2,286	2,571	2,857
Dried blood (10 per cent N).....	200	400	600	800	1,000	1,200	1,400	1,600	1,800	2,000
Fish scrap (8 per cent N).....	250	500	750	1,000	1,250	1,500	1,750	2,000	2,250	2,500
Carriers of phosphoric acid (P₂O₅):										
Superphosphate (16 per cent P ₂ O ₅).....	125	250	375	500	625	750	875	1,000	1,125	1,250
Superphosphate (20 per cent P ₂ O ₅).....	100	200	300	400	500	600	700	800	900	1,000
Double superphosphate (40 per cent P ₂ O ₅).....	50	100	150	200	250	300	350	400	450	500
Ground bone ² (23 per cent P ₂ O ₅).....	87	174	261	348	435	522	609	696	783	869
Carriers of potash (K₂O):										
Potassium sulphate (50 per cent K ₂ O).....	40	80	120	160	200	240	280	320	360	400
Potassium chloride (50 per cent K ₂ O).....	40	80	120	160	200	240	280	320	360	400
Kainit (12.5 per cent K ₂ O).....	160	320	480	640	800	960	1,120	1,280	1,440	1,600
Manure salts (20 per cent K ₂ O).....	100	200	300	400	500	600	700	800	900	1,000

¹ Where the combined materials do not total 2,000 pounds a filler may be used to bring up the mixture to that weight.

² Ground bone also carries nitrogen.

Examples

To make up a ton of a 4-8-4 mixture in which the nitrogen is one-third ($1\frac{1}{3}$ times 133 pounds=178 pounds) in the form of nitrate of soda, one-third in the form of sulphate of ammonia, and one-third in organic form from cottonseed meal, the phosphoric acid is from 16 per cent superphosphate, and the potash is from 50 per cent potassium chloride (also known as potassium muriate), the following materials would be used:

	Pounds
Nitrate of soda	178
Sulphate of ammonia	134
Cottonseed meal.....	380
Superphosphate (16 per cent).....	1,000
Potassium chloride.....	160
Filler (ground dried peat).....	148
Total.....	2,000

Since the fertilizer materials add up to 1,852 pounds, 148 pounds of a filler is added. This filler may be a conditioner as well and often has some fertilizer value in itself. Dried peat, ground phosphate rock, ground limestone, or even sand may be used. The total is so near 2,000 pounds that it may be considered unnecessary to bother with a filler. When the total of the mixture is appreciably less than 2,000 pounds, it may be perfectly satisfactory to use a smaller quantity of fertilizer per acre rather than to dilute with filler. Thus, if you are making a ton of 4-8-4 mixture, in which the sum of the materials used is 1,500 pounds without filler, by using three-fourths of the normal application, the filler can be omitted.

The mixture just given is a good general fertilizer which may be used for cotton on some types of soil. Its nitrogen is in different degrees of availability. The cottonseed meal in this mixture, besides its fertilizer value, is an excellent conditioner. A mixture such as this will drill well and when properly stored should remain several months in good drillable condition. It is possible to make other mixtures which would have the same ratio of nitrogen, phosphoric acid, and potash, such as 5-10-5, 8-16-8, 10-20-10, and even 15-30-15. As the number of units increases, however, the difficulty of keeping the mixture in condition and of distributing it evenly in the soil may increase. A 5-8-7 analysis might contain the following:

	Pounds
Nitrate of soda.....	266
Ammonium sulphate.....	200
Animal tankage (8 per cent) or fish scrap.....	250
Treble superphosphate (40 per cent).....	200
Superphosphate (16 per cent).....	500
Potassium chloride.....	280
Dried peat or garbage tankage as filler or conditioner.....	304
Total.....	2,000

This mixture contains 5 per cent nitrogen, 2 per cent being supplied from nitrate of soda, 2 per cent from sulphate of ammonia, and 1 per cent from animal tankage (8 per cent) or fish scrap; 8 per cent phosphoric acid, supplied partly from 16 per cent superphos-

phate and partly from treble superphosphate (40 per cent); and 7 per cent potash from potassium chloride. Filler or conditioner may be dried peat, garbage tankage, or similar material. The example shows 4 per cent of phosphoric acid from each source, but if it is desired to cut down the amount of filler this is readily done by putting in more 16 per cent superphosphate and correspondingly reducing the amount of 40 per cent goods. Potassium sulphate may be substituted for all or part of the potassium chloride used above, if desired.

This mixture is suitable for potatoes, in a number of potato-growing sections, and also makes a good garden fertilizer, especially on sandy soils, which have a special need for potash.

A 7-6-5 analysis may be made of the following materials:

	Pounds
Nitrate of soda.....	400
Ammonium sulphate.....	300
Cottonseed meal.....	285
Superphosphate (16 per cent).....	750
Potassium chloride.....	200
Filler and conditioner, dried peat, etc.....	65
Total.....	2,000

This mixture is often used for early potatoes and truck crops on sandy soils in the eastern trucking regions. It is high in quickly available nitrogen.

An 0-20-20 analysis may be mixed as follows:

	Pounds
Potassium chloride (50 per cent).....	800
Treble superphosphate (40 per cent).....	1,000
Dried muck or ground limestone	200
Total.....	2,000

This is a fertilizer suitable for muck lands where it is felt nitrogen is not needed. Dried muck under these conditions is often available to the farmer as a conditioner.

A 2-12-2 analysis may be made as follows:

	Pounds
Ammonium sulphate.....	200
Superphosphate (16 per cent).....	1,500
Kainit.....	300
Total.....	2,000

This should be used as soon as mixed, as it may cake on standing. A 2-12-2 analysis may also be made up by mixing the 4-8-4 mixture already given with an equal weight of 16 per cent superphosphate. This will divide the percentage of nitrogen and potash in half and will build up the content of phosphoric acid to 12 per cent. This example shows how the farmer may readily modify other fertilizer mixtures to suit his needs or wishes. Suppose he can purchase to advantage a concentrated fertilizer analyzing 15-30-15 but desires to use a fertilizer drill which he thinks more suited to a lower-grade mixture. He also prefers, for local conditions, a greater proportion of phosphoric acid. He may combine 1 ton 15-30-15 analysis commercial fertilizer, 1 ton superphosphate (16 per cent), and 1 ton of inert material, such as sand or sandy soil, and prepare 3 tons of ap-

proximately 5-15-5 goods. Other concentrated mixtures may be used in a similar manner.

Among simple mixtures which have given satisfaction for lawns are the following:

Ammonium sulphate.....	1 part.
Cottonseed meal.....	3 parts.

This is used as a top-dressing for lawns where it is desired to make the soil more acid. It may be applied at the rate of 2 pounds per 100 square feet. It supplies nitrogen to stimulate leaf growth. Where it is desired to make the soil less acid, nitrate of soda may be substituted:

Nitrate of soda.....	1 part.
Cottonseed meal.....	3 parts.

A compromise mixture which should not change, to any great degree, the reaction of the soil is as follows:

Nitrate of soda.....	1 part.
Sulphate of ammonia.....	1 part.
Cottonseed meal.....	6 parts.

On many farms and gardens poultry manure is available. When this has been stored under cover it is a good material to use in home mixtures, if screened and pulverized. As it is relatively low in phosphoric acid the following mixture has been recommended:

Dried poultry manure	9 parts.
Superphosphate (16 per cent).....	1 part.

The superphosphate is a good preservative of the manure, when mixed with it before or during storage.

Other dried animal manures are also satisfactory in fertilizer mixtures. A large amount of goat manure is brought to this country from South America for this purpose. Bat manure is available in certain sections.

Profits From Home Mixing of Fertilizers

Usually home mixing will show a profit, but the farmer will have to investigate and determine what materials and mixed goods cost in his community and then make his decision. His county agent is often in a position to help him decide.

